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UNITED STATES DEPARTMENT OF AGRICULTURE

BUREAU OF ENTOMOLOGY

FOREST INSECT INVESTIGATIONS

THE DOUGLAS FIR BEETLE SITUATION CODY CANYON SHOSHONE NATIONAL FOREST

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Dr. F. C. Craighead,
U. S. Dept. of Agri.,
Bureau of Entomology & Plant Quarantine,
Washington, D. C.

Dear Sir:

Please find enclosed two copies of a paper "The Douglas Fir Beetle Situation Cody Canyon, Shoshone National Forest", which attempts to summarize the available data secured from the past four years of control and to depict the existing situation in relation to the future. The extra copy is intended for the information of the Forester.

This summary shows that as a result of control, the Douglas fir beetle infestation in Douglas fir stands weakened by the spruce budworm, has been reduced 82 percent and that the project has been successful in preventing the destruction of any trees which might be considered as of scenic importance to the area. As there are areas severely defoliated by the spruce budworm that harbor infestations of the Douglas fir beetle that were not included in the bark-beetle project, there has been an annual reinfestation of the treated areas from this source of supply. Because of this reinfestation, the Douglas fir beetle outbreak has apparently been reduced to a point where further reduction of any great magnitude cannot be expected until the source of supply has been eliminated. However, as the attacks during the past two seasons have been much lighter than previously recorded, this can be assumed to indicate that the sources of reinfestation are becoming exhausted.

In the spring of 1934, a change in the administration of control was instituted which was expected to provide for an increase in the population of beneficial insects. This plan called for the treatment of newly attacked trees in the spring prior to the emergence of the beneficial insects from the old trees. This increase in insect population was expected to care for the infestation which remained after the cessation of control. However, control should not be discontinued until the source of supply has been well exhausted if permanency in the results already obtained is desired.

As the cessation of the project at this time could only result in the rebuilding of the outbreak to an epidemic status and the loss

of the success already attained, it is recommended that control be continued during the season of 1935. It is furthermore recommended that provision be made for the institution of control in the spring of 1935 and that the organization be of sufficient strength to cover all of the areas for which control is deemed necessary in the allotted time. Although, of course, no accurate estimate can be given as to the funds necessary, it is expected that there will not be more than 2000 trees to treat which, under the present wage scale, would require about $4500.

Respectfully,

James C. Evenden
Entomologist

Cc to J. M. Miller, Berkeley, California &
F. P. Keen, Portland, Oregon

THE DOUGLAS FIR BEETLE SITUATION CODY CANYON, SHOSHONE NATIONAL FOREST

The Cody Canyon bark-beetle control project of the Shoshone National Forest was instituted in 1931. This project was directed against an outbreak of the Douglas fir beetle (Dendroctonus pseudotsugae Hopk.) in stands of Douglas fir which had been previously subjected to severe defoliation by the spruce budworm, (Cacoecia fumiferana Clem.) During the past four years, reports depicting the results secured by control and recommendations for further work have been submitted subsequent to each step of the operation.

With the data secured from the 1934 operation, it seems well to study the results of the past four seasons of control, and to attempt a prediction as to what the future may hold in store. With this idea, the following paper has been prepared for the purpose of offering as complete a depiction of the existing situation as is possible from the information available.

An outbreak of the spruce budworm within the Douglas fir forests of the Cody Canyon, Shoshone National Forest, was first recorded in 1922. This outbreak developed rapidly and by 1930 had spread over a large area. Though no data as to the extent of the outbreak are available, thousands of acres were infested, leaving a tremendous number of Douglas fir trees so severely weakened that they became an easy prey to bark-beetle attack. By 1930, there were many

areas of dead trees in the different drainages of the Canyon for which defoliation was considered directly responsible. However, during the development of the budworm epidemic, the weakened host material had contributed to such a rapid development of the Douglas fir beetle that its work could be found in nearly all of the dead trees with evidence that brood had been successfully produced. What percentage of these trees would have died from the effects of defoliation alone is problematical. As attacks of the Douglas fir beetle are confined to cambium tissues fairly comparable to those found in healthy trees, it is evident that these trees were not dead at the time of attack. On the other hand, many of the attacked trees were so severely defoliated that they could not have survived. Unquestionably, the spruce budworm is responsible for a large percentage of the timber loss that has occurred as a result of these two interrelated insect epidemics and that the Douglas fir beetle infestation was an associated factor of no economic importance until it reached such a magnitude that trees were attacked that had not been severely defoliated.

Though previously known that the Douglas fir beetle was present within the defoliated area, it was not until the summer of 1931 that it began to attack trees of scenic value to various resorts. It had been rather doubtfully predicted that this condition would not occur, though the possibilities were fully recognized. A similar situation within the Yellowstone Park near Camp Roosevelt had been used as a basis for this prophecy. Here there were thousands of defoliated

Douglas fir trees heavily attacked by the Douglas fir beetle, with no spreading of the infestation from the defoliated area into the uninjured stands adjacent.

Following the discovery of bark-beetle attacks in trees that had not been severely defoliated and which were of scenic value to Blackwater Lodge, control measures were instituted the same season or in the fall of 1931. The following tabulation presents a statistical history of the project.

STATISTICAL HISTORY OF THE CODY CANYON BARK-BEETLE CONTROL PROJECT 1931-1934

Areas	Acres	Trees treated 1931	Trees treated 1932	% change in status from '31 to '32	Trees treated 1933	% change in status from '32 to '33	Trees treated 1934	% change in status from '33 to '34	% change in status from first treatment '31 to '34
Bloom Cr.	144	878	225	- 74		- 85*		-100*	-100
Moss Cr.	272	733	291	- 60		-100*	213	+213*	- 70
Cedar Cr.	20	122	57	- 53	21	- 63		- 80*	- 96
Libby Cr.	168	46	115	+150	88	- 23	80**	- 9	+ 74
Fishhawk Cr.	786	275	489	+ 77	325	- 33	228	- 29	- 17
Chimney Flat	26	198	120	- 39	4	- 96		-100*	-100
Mesa Cr.	171	315	469	+ 49	152	- 67	91	- 40	- 71
Sheep Cr.	265	407	890	+118	271	- 69	114	- 57	- 72
Blackwater Cr.	1052	4,833	1369	- 71	34	- 97	49**	+ 44	- 99
June Cr.	852	2,271	751	- 66		-100*		+ 52*	- 97
Beetle Gulch	395	1,796	596	- 66		- 93*	20	- 44	- 98
Lower Gulch	30	164	104	- 36		- 91*	33	-267	- 80
Mormon Cr.	204		40		38	- 05	35**	- 7	- 12
Newton Cr.	95		259		55	- 78	85**	+ 54	- 67
Bliff Cr.	65		333		73	- 78	77**	+ 6	- 76
Gunbarrel Cr.	424		1037		526	- 49	263**	- 50	- 74
Lost Draw	26		14		41	+193	54**	+ 31	+286
Dead Horse	28		136		64	- 53	95	+ 48	- 30
Chimney Rock Cr.	101		480		71	- 85	15***	- 78	- 96
Elephant Head	12		39		9	- 76	10**	+ 11	- 74
Palisade Cr.	1140		490		288	- 41	245**	- 14	- 50
Libby Flatt	49		39		10	- 74	23	+130	- 41
Aspen Cr.	400								
Aspen Ridge	119				306		215	- 29	- 29
Little Dead Horse	25				65		18	- 72	- 72
Rieneckers	17				67		131*	+ 95	- 95
Goff Creek					4		21**	- 50	- 50
TOTALS	5889	12,038	8343	- 30	2512	- 69	2096	- 16	- 82

*Figure based upon the data secured from the survey. Infestation not sufficiently heavy to warrant control

**Areas treated in the spring of 1934. Other areas treated in the fall.

From the preceding tabulation, it will be noted that only 71 percent of the total acreage of the infestation unit was covered by control in 1931. This does not mean that there was no infestation in the other areas at that time, but that due to the rapid development and execution of the project they were overlooked. There were some marked increases to the area treated in 1932, some slight additions in 1933, but none in 1934. As in 1931, these areas were perhaps as heavily infested as those treated, it is evident that if they had been included in the project, a reduction greater than the 30 percent indicated by the preceding tabulation would have followed. It will be noted that this figure was secured from a comparison of the total number of trees treated in 1931 and 1932, with no consideration to the size of the areas involved. If the trees treated in 1931 were compared to the trees treated on the same area in 1932, a 54 percent reduction would be shown. Likewise, a comparison of the trees treated on this area in 1931 and 1933, would show a 92 percent reduction, while from 1931 to 1934, the figure would remain practically the same or 93 percent. This computation shows the actual results of four years control on the same acreage, or a reduction from 12,038 trees in 1931 to 828 in 1934. If any discredit is thrown on these data, it should be in favor of the operation, as the results of control were no doubt influenced somewhat by the spread of insects from the untreated into the treated areas. Regardless of this computation, a reduction of 82 percent has been secured throughout the entire unit as a result of control with much lighter attacks and broods than occurred in previous years.

From the preceding tabulation, it is perhaps difficult to understand the variation in the results which followed the first year of control. In explanation of these results which varied from a reduction of 74 percent to an increase of 150 percent, it must be remembered that infestations of this character are far more difficult to control than when healthy trees are involved. The trees infested with Douglas fir beetles had been seriously weakened by budworm defoliation, and as a result could offer no resistance to attack. Such a condition permits a few beetles to make successful basal or one-sided attacks and produce abnormally heavy broods. Furthermore, infestations of this character present certain physical difficulties to the task of spotting as heavy broods of beetles were found in trees which under normal conditions would appear to have been dead for years. This required that all dead trees be examined and as a result, considerable infested bark surface was missed and left untreated during the first few years of this project. This factor was of minor consequence during the past year of this project due to the absence of such heavily defoliated trees.

Though the 1933 operation covered all of the infestation unit where control was considered necessary, and was as efficient as could be expected from any operation, there was still reinfestation in 1934 equal to 86 percent of the 1933 infestation. Regardless of this efficient work, it seems impossible to secure further material

reductions and there is but one conclusion that can be drawn. To account for this reinfestation, one must turn to the spread of insects from the untreated areas at the heads of the various side drainages and canyons and in pockets of the many rock cliffs. This condition was appreciated at the time the project was instituted, but due to the expense involved, a complete cleanup of the Douglas fir beetle infestations throughout the entire defoliated area was considered impracticable.

The spraying program instituted in 1930 against the spruce budworm was directed towards the preservation of the timber stands along the roadside and around the summer homes, dude ranches, and camp sites. As in 1931 the Douglas fir beetle infestation threatened to destroy the success of this operation, bark-beetle control measures were instituted with the same objective. To accomplish this, the project was directed towards the treating of all infested trees along a strip a mile or more in width on each side of the river, for as stated, a complete cleanup seemed impracticable. That these untreated areas are now acting as a source of reinfestation to the treated areas can hardly be questioned.

Regardless of the reinfestation which has occurred annually, the project has reduced the beetle population within the infestation unit by 82 percent, and successfully prevented the loss of any trees which might effect the immediate attractiveness of any of the resorts, etc. In considering this project as successfully accomplishing its

objective, no economic justification for the operation has been presented, as it is the primary purpose of this paper to consider entomological angles only.

Before discussing the future of the project, there is a phase of the operation that was instituted in 1934 which should be presented. I refer to the changes in control administration which were instituted for the purpose of making the control measures as near biologically sound as possible. It will be recalled that during this operation infested logs were decked and burned, which destroyed both destructive and beneficial insects and though resulting in a reduction of the beetle population, made no change in the potential power of the infestation to increase. This weakness of the control measures in use presented a problem that was attacked with the idea of determining how beneficial insects could be preserved. It was found that though the important parasite of the Douglas fir beetle (Coeloides brunneri Vier) overwintered in the same trees as the beetles, they did not emerge until late June or approximately six weeks after the overwintering adult beetles. This delay is necessary to permit the beetle brood in newly attacked trees to reach the proper stage of development for parasitization. This fact suggested a possible solution to the problem by instituting control in the spring and treating the newly attacked trees, while the Coeloides are in the old trees in which the beetles overwintered. Through this method, it was hoped the parasitic population would be increased to such a degree

that they would care for any infestation missed by control and permit the cessation of the project. This plan was inaugurated in the spring of 1934, however, it is regretted that the entire infestation unit was not covered as planned. Though the remainder of the area was treated later in the season, this is a condition that should be corrected in all subsequent spring operations, as emerging parasites may have been forced into the untreated units adjacent for more accessible host material, and of course subsequently destroyed during the fall operation. It is understood that such an occurrence would tend to defeat the benefits of the plan. Regardless of this fact, an intensive examination made in the fall of 1934 showed that there had been a rather marked increase in the Coeloides population in the 1934 attacked trees, as compared to those attacked in 1933, which would seem to indicate the soundness of the plan. I sincerely believe that spring operations should be continued in all subsequent plans for the control of this beetle in this area, and that the organization should be of sufficient strength to cover the entire unit in the time allotted. This belief is based upon the assumption that this plan places our method of control on a sound biological foundation.

Though the project has successfully accomplished its objective, its future is somewhat difficult to foresee. In studying the reduction in the number of trees treated from year to year, we have the following data: From 1931 to 1932, a 30 percent reduction; from 1932 to 1933, a 69 percent reduction; and from 1933 to 1934, only 16 percent.

The reason for the small reduction from 1931 to 1932 has been explained as due to the difference in area covered. However, the small reduction which followed the 1933 operation, would seem to indicate that further control cannot be expected to reduce the outbreak to any great extent until the source of reinfestation has been exhausted. The number of years which will be required to accomplish this is of course unknown, but it is sincerely believed that the cessation of control at this time could only result in permitting the outbreak to rebuild to an epidemic status. Not only has a marked reduction been made in the infestation from that which existed in 1931, but in 1934 the attacks and resulting broods were materially lighter than during previous years, indicating that the source of reinfestation has been materially reduced.

It must be understood that the spruce budworm plays an important part in the control of the Douglas fir beetle. Though the budworm outbreak is not as severe as existed a year or two ago, it still persists, and in some areas the defoliation has been very severe. As long as this defoliation continues to provide attractive host material for the attacks of the Douglas fir beetle, a source of reinfestation to the areas where beetle control has been conducted will be maintained. From time to time indications have resulted in predictionsthat the budworm epidemic was waning and that the outbreak would soon die out. These predictions have so far been met with tremendous numbers of moths and subsequent severe defoliating the following season. The interrelationship of these two factors make the future of this project

difficult to foresee. However, it is believed that if control measures are directed so as to preserve the beneficial insects, the beetle population can be reduced to a point which would permit the project to be abandoned.

Though the entomological policy involved in this project has been proven to be sound, an economic justification for past and future control is an issue which I shall not comment upon to any great extent. Approximately $47,845 exclusive of annual surveys, have been spent on the project since 1930. This amount includes approximately $11,000 for the spraying operation. In my opinion, the cessation of the project at this time would very likely result in the rebuilding of the infestation to an epidemic status, and the loss of the trees for which protection was especially desired. It is, therefore, recommended that this project be continued in the spring of 1935 and that the work be organized on a scale sufficient to cover all of the areas where control is deemed necessary. This laboratory will assume the responsibility of conducting the necessary surveys for the purpose of directing the work to the areas where control is required.

As spring control must be instituted very soon after the new attack starts, surveys cannot be made, and reports submitted requesting a specific allotment of funds. It is necessary to plan for the institution of control and provide sufficient funds so that as fast as surveys are made of the various areas, control can be instituted immediately wherever necessary.

As a basis to plan for the 1935 spring operation, it can be estimated that there will not be more trees to treat in 1935 than there were in 1934. The cost of this operation, under present wage scales, would be about $2.00 per tree, or a total of $4500.

Respectfully submitted,

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Coeur d'Alene, Idaho
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